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Shoshone Falls, on the Snake River, Idaho.

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WATER POWER RESOURCES OF SOUTHERN IDAHO

BY E. A. WILCOX.

The advancement made in the practical application and use of electric power during the past one or two decades has revolutionized the industrial and civic welfare of the world to such an extent that the opportunities and capacities for development of electric energy is today deemed one of the most valuable natural resources of any locality. It is, therefore, natural that the great power sites of Southern Idaho are considered as one of its greatest assets, and its rapid development and growth can be attributed in a large way to this great natural advantage.

The general relief of Idaho with its high snow-capped mountain ranges and its extensive valleys and plains, provides watersheds to furnish wonderful, never-failing water supply for the creation of large rivers and streams. The natural fall of these streams is such that unlimited power may be harnessed and put to practical every day use.

Perhaps the most remarkable opportunities for power development are found on the Snake River in the central portion of its semi-circular course across Southern Idaho, in and through the great Twin Falls country where immense irrigation tracts have so recently been developed by the Kuhn interests of Pittsburg and other enterprising capitalists.

Copyrighted by C. E. Bisbee, 1909 Twin Fall of Snake River, Idaho.

Between American Falls in Power County and Glenns Ferry in Elmore County, a distance of but two hundred miles, the river drops many hundreds of feet. The fall is not a gradual one, but rather consists of a succession of abrupt changes in elevation of the river bed, whereby natural head developments are made feasible and practical. On account of the moderate climate and the many springs that flow into Snake River in this vicinity, ice never forms in the stream and trouble from this or similar sources is unknown even during the most severe winter seasons.

At American Falls, the Southern Idaho Water Power Company, a Kuhn enterprise, is now developing approximately 6500 horsepower, and an eventual development of 40,000 horsepower has been mapped out. The head at the site is about 50 ft. Energy from this plant is at present transmitted over a line some 60 miles in length, and is being supplied to Pocatello, American Falls, Ross Fork and Blackfoot.

At Minidoka, the United States Reclamation Service has completed a plant having an aggregate capacity of 7500 horsepower, which is being utilized mainly for the operation of irrigation pumping plants and for lighting, heating and power purposes on the government projects.

Exterior Twin Falls North Side Plant No. 2.

At Twin Falls on the Snake River, a direct head of 150 ft. is available, and a modern development of 10,000 horsepower is contemplated. When completed, this will be one of the best and most attractive power installations in Southern Idaho, and will form a part of the Great Shoshone and Twin Falls Water Power Company's present system.

The Kuhn interests have constructed a large power plant at Shoshone Falls of 2000 horsepower capacity, which is now being increased to 7500 horsepower, the necessary provisions in the hydraulic installation having been made for an ultimate development of 15,000 horsepower. It is a natural head plant, and makes use of a 200 ft. fall in the river.

The Auger Falls site, located a few miles below Shoshone Falls, makes a drop of 125 ft., and is capable of furnishing 10,000 horsepower without in any way augmenting the stream flow.

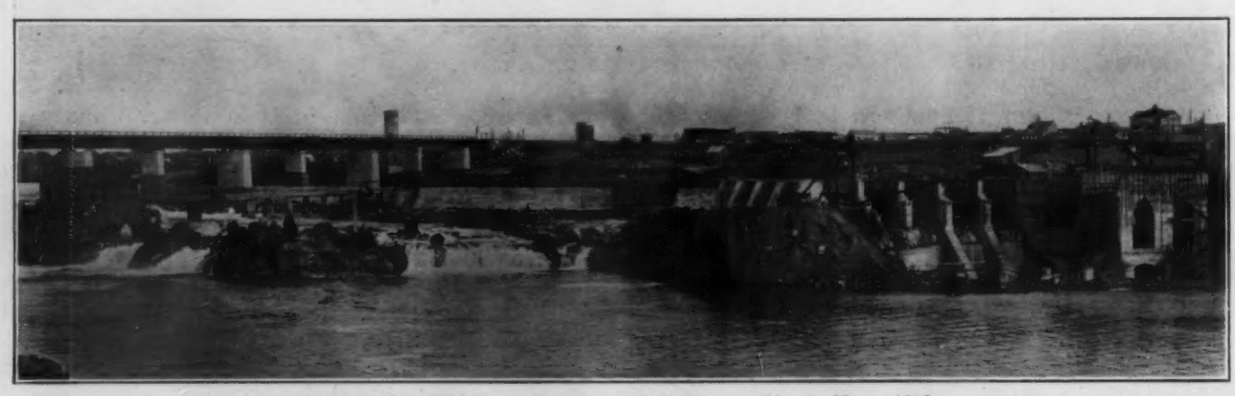
A power plant designed to harness 8000 horsepower has been constructed at Thousand Springs where several hundred second feet of water empties into the Snake River from an elevation of 175 ft. A generating capacity of 3000 horsepower has already been installed and the plant connected to the system of the Great Shoshone and Twin Falls Water Power Company.

The canal work and excavations for one of the largest power developments in the State have recently been completed at Upper Salmon Falls. This great earth and rock canal will be lined with concrete through its entire length of one and a half miles. It is 42 ft. wide on the bottom, and will carry 5000 second ft. of water with a depth of 12 ft. The plant when finished will have sufficient capacity to furnish 40,000 horsepower. The installation will be one of the most complete and up-to-date hydroelectric equipments yet constructed by the Kuhn Interests.

The Lower Salmon power plant, designed and engineered by the Great Shoshone and Twin Falls Water Company, has a present capacity of 5500 horsepower, which will shortly be enlarged to five times its present size. The available head is 50 ft. The buildings and machinery are of the very best designs and types of construction.

At the Malad River, the Beaver River Power Company has constructed a power house near where the stream flows into the Snake River. The plant contains a 5500 kw. unit. Water is diverted from the flume of the King Hill Irrigation Company by means of a large penstock and only a portion of the available head of the stream made use of. The Great Shoshone and Twin Falls Water Power Company is now constructing a much more extensive development at this point, the water being diverted considerably higher up the river and being returned much further down stream. When completed, the plant of the latter company will be one of the best installations in Southern Idaho, and will be capable of developing at least 15,000 horsepower.

The Idaho Power & Transportation Company has a development on the Upper Snake River near Idaho Falls that supplies electricity for lighting and power service in Idaho Falls, Rigby, Rexburg, Sugar City, and St. Anthony. There are a number of power possibilities on the upper Snake River, but these are in-



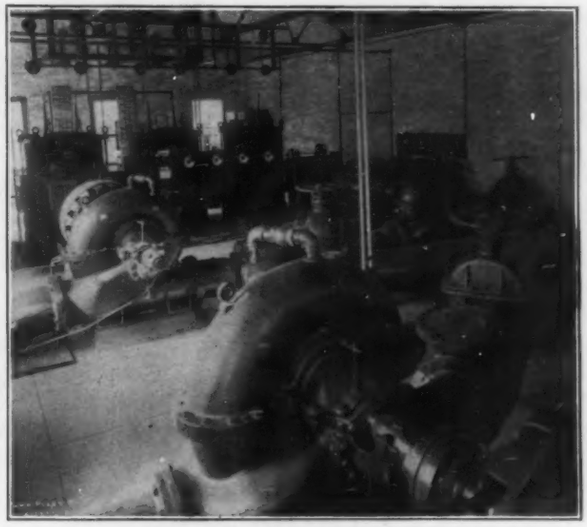
Construction Work on American Falls Power Plant, Nov., 1912.

cluded in the Forest Reserve, and the means by which they are to be developed is a problem of the future.

The Idaho-Oregon Light & Power Company, of Boise, Idaho, produces power from three hydroelectric plants, the Barber plant on the Boise River, the Horseshoe Bend plant on the Payette River, and the Swan Falls plant on the Snake River. These plants have a combined capacity of at least 12,000 horsepower, and may be enlarged to double that amount. The same company has a large power plant partly completed at Ox Bow on the Snake River, which will be capable of delivering at least 30,000 horsepower of electrical energy. The larger cities and towns supplied by this company are Boise, Nampa, Caldwell, Ontario, Payette and Weiser.

The chief hydroelectric enterprises in the southeastern part of Idaho are the Bear Lake Power Company, having a plant on Paris Creek, and supplying Montpelier, Paris and other neighboring towns; the High Creek Power Company, having a plant on Cub River, and supplying Preston, Idaho, and a number of northern Utah towns, and the Telluride Power Company at Grace, Idaho, on the Bear River, which delivers power over a long transmission line into Salt Lake, Utah, and other cities and towns adjacent thereto. The electricity being supplied by these companies is being used very largely for manufacturing and mining purposes and for the operation of electric railway systems in Utah.

Typical Pumping Plant in Twin Falls Country.

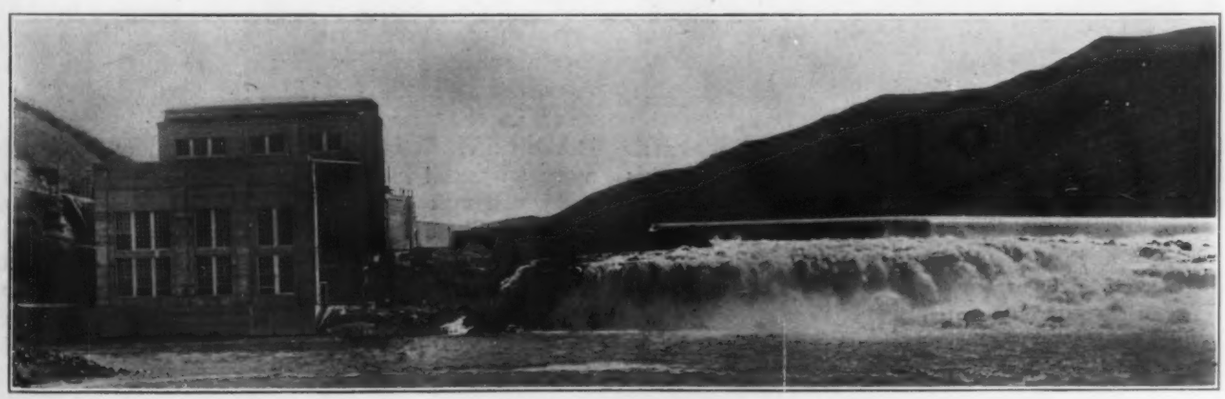


Interior Twin Falls North Side Plant No. 2.

Irrigation Pumping.

Pumping plants operated with electric motors and made to irrigate tracts of land on a large scale are a comparatively new means of development. There are at least 150,000 acres of land in Idaho watered by this means alone, and there are at least 200,000 acres of land yet in sagebrush that can be irrigated by no other means. The power companies that have done most to bring about the tremendous development that has taken place are the Great Shoshone & Twin Falls Water Power Company of Twin Falls, Idaho, the Southern Idaho Water Power Company, the Government Reclamation Service of Boise, Idaho, and the Idaho-Oregon Light & Power Company of Boise, Idaho.

The largest pumping project in the world is located near Minidoka, Idaho, and was completed three years ago by the Government Reclamation Service. Forty-eight thousand acres of land are watered under this system with lifts varying from 30 to 90 ft. The High Line pumping project near Twin Falls, Idaho, comprises 4000 acres of land, and is watered with lifts varying from 40 to 80 ft. The Twin Falls North Side pumping project, a Kuhn enterprise, is composed of



Lower Salmon Falls and Power House.

14,000 acres of land segregated under the Carey Act law. The lifts vary from 35 to 90 ft. in height. The Indian Cove project near Mountain Home, Idaho, comprises 4000 acres of land under 100 ft. lift. The Snake River pumping project near Grand View, Idaho, is composed of 15,000 acres of fruit land watered with lifts varying from 40 to 150 ft. With the exception of the Minidoka plant, all the above pumping projects obtain power from the Great Shoshone & Twin Falls Water Power Company.

The larger pumping plants supplied with power by the Idaho-Oregon Light & Power Company are the Payette Heights plant, covering 4000 acres under 140 ft. lift; the Payette Oregon Slope plants covering 7000 acres under lifts of 40 and 100 ft.; and the Kingman Colony plant, covering 2500 acres under several lifts varying from 30 to 70 ft. The same company is supplying power for the operation of many smaller plants, and is preparing to deliver electrical energy to several plants now in course of construction.

One of the largest pumping projects yet to be installed in Idaho and known as the Gem Irrigation Project is now being built near Caldwell, Idaho. It comprises about 35,000 acres of land, and will make use of at least 5000 horsepower of energy for operating the plant.

Electric Heating.

Hand in hand with the development of irrigation pumping enterprises has come the adaptation and general use of electrical energy for heating purposes in the territory supplied by the power companies. It is only in a country where current can be disposed of for irrigation and other uses during the summer that surplus power may be made use of for general

Electric Kitchen at Twin Falls, Idaho.

heating purposes in the winter season. Nor is this great natural agent being utilized exclusively in the homes of the rich; it is, on the contrary, being enjoyed by all classes of people for heating dwellings, hotels, offices, churches, school houses and other buildings. Electric heating apparatus is comparatively inexpensive to install, and has been found thoroughly clean, safe and economical as compared with fuel heat. It must be tried in order to fully appreciate its convenience and other natural advantages.

Among the more recent adaptations of electricity is its application to general use in the kitchen. The several power companies have adopted a liberal basis of charge for current used for cooking purposes. An idea of the rapidity with which this means of cooking is being adopted may be gained by stating that in the Twin Falls country alone sixty complete electric ranges were sold by the Great Shoshone & Twin Falls Water Power Company during August and September of the past year.

Electricity on the Farm.

The use of electricity is being adopted very widely on the Idaho farm. It is used for general lighting, heating and cooking purposes and for driving the machinery such as feed grinders, alfalfa mills, water pumps, fanning mills, threshing machines and miscellaneous farm devices. The power companies have been very liberal in extending their lines to the different farms. Especially is this true of the Great Shoshone & Twin Falls Water Power Company, which has constructed many extensions through the more thickly populated agricultural districts depending upon the future development of the territory to warrant the necessary expenditures.

Improvement of Transportation Facilities.

A number of electrical railway enterprises have been in successful operation in Boise and through the neighboring towns and agricultural communities for several years. These railroads are constantly extending their trackage and improving their service. Lately, a number of electric railway enterprises have sprung up in the southern portion of the state in the more densely populated districts. The most recent electric road to be built is in the Twin Falls country. It is being constructed by the Twin Falls Railway Company, and electric trains will soon be running between the city of Twin Falls and Shoshone Falls. The cars will be operated by means of the new Edison storage battery. Twelve miles of grade have been built, the ties laid, and a large part of the rails have been placed. The road is of a gauge that will permit handling standard freight and passenger cars.

With the possibilities for the development of water power enterprises in Southern Idaho and with the unprecedented number of ways in which electricity is being applied to the service of mankind in his industrial and civic life, it is difficult to imagine the wonderful future of the state that will obtain from the further harnessing of the present dormant water power resources and the further education of the public mind in the practical applications of electricity in modern life. It is certain to bring about better and more advanced methods of living; it will encourage and broaden the manufacturing industries of the state; it will increase and improve transportation facilities; and it will remove the drudgery and make farm and home life more attractive. The future possibilities and successes of southern Idaho are interlocked very closely indeed with the wonderful facilities afforded for the development and use of water-power.

ELECTRICAL PUMPING AND IRRIGATION

INLETS AND OUTLETS TO FLUMES.

BY B. A. ETCHEVERRY.

Increased velocity at inlet.

To reduce the cross section and size of a flume it is always desirable, especially for long flumes, to use a high velocity. The maximum velocity will depend on the fall available and on the erosive effect of the water on the material forming the waterway. To change from the canal section to the flume section it is necessary to design the inlet as a transition, allowing sufficient fall in the water surface to produce the increased velocity. For very short flumes it may be more economical to make the flume section more nearly equal to the canal section, for the transition cannot be made abruptly and a long transition may be more expensive than the cost of a larger flume.

Decreased velocity at outlet.

To decrease the velocity at the outlet from the high velocity in the flume to the lower velocity in the canal, one is theoretically justified in providing for a raise in the water surface equal to the difference in velocity heads less the loss in head due to friction and impact in the transition.

Objects of inlet and outlet.

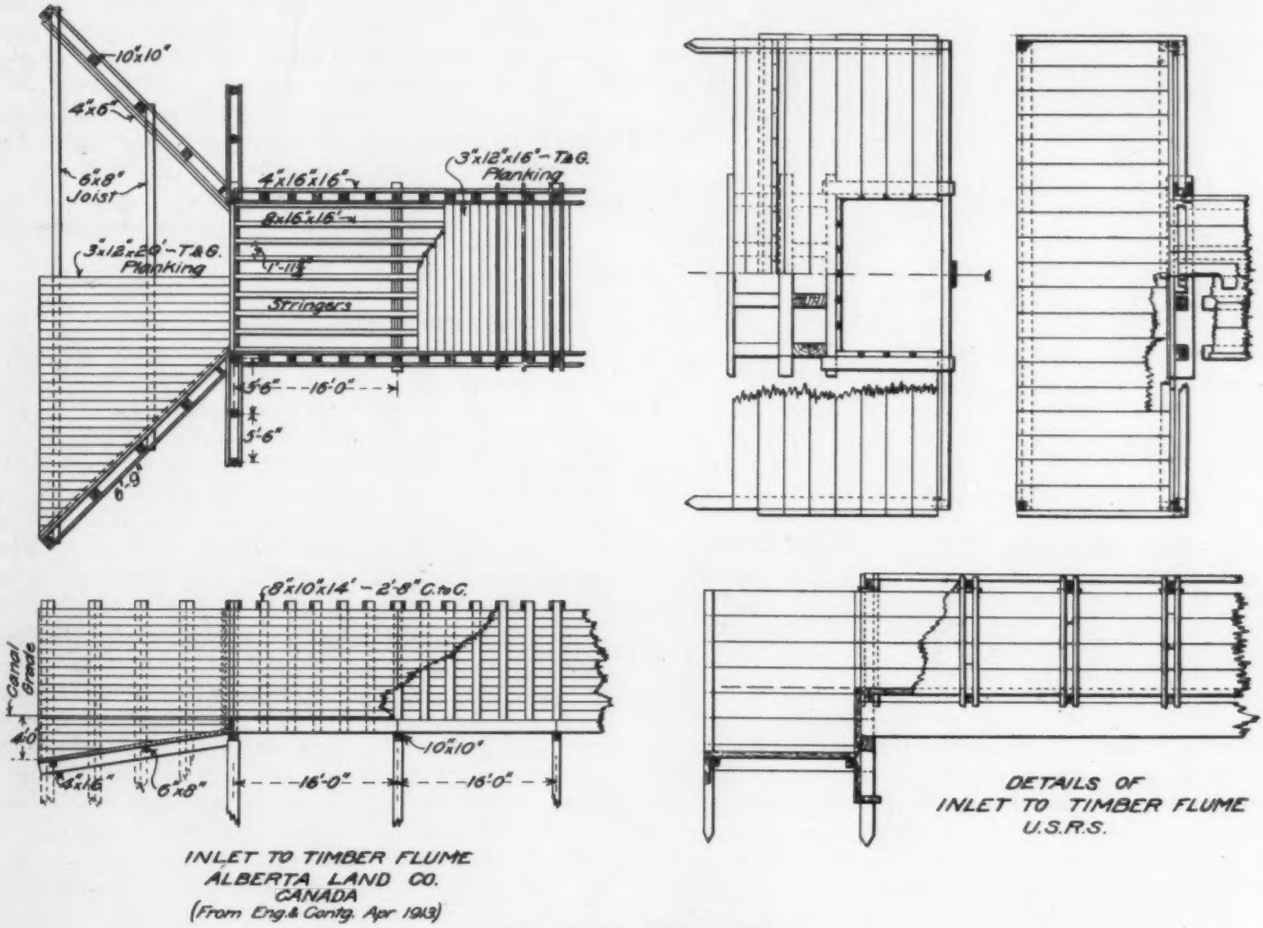
The objects of the inlet and outlet are:

1. To make the change or transition from the canal section to flume section and vice versa.

2. To make connections between the canal and flume and to protect the ends of the flumes.

Design of inlet and outlet.

The inlet and outlet consist of the wings, the floor and the connections between wings and canal.



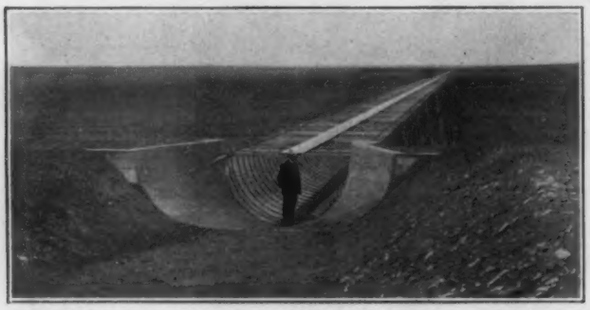
Typical Timber Flume Inlets.

Form of wings.

To make the transition from the canal section to the flume section, the forms of inlet and outlet wings are: I, Warped wings; 2, Wings placed on an acute angle to the axis of flow; 3, Wings placed at right angles to the axis of flow.

Warped wings or warped channels built of staves or of concrete or of metal are no doubt the best solution, especially for semi-circular flumes, but the increased cost and difficulty of construction are sometimes an objection. However, for a permanent steel or concrete flume the extra cost is well justified, espe-

cially if the available grade is small. Stave warped wings are used only for wooden stave flumes; concrete warped wings may be used for all the types of flumes. Metal warped wings may be used with steel flumes. In changing from a flat canal slope to either the vertical side or curved side of the flume, the slope of the warped surface becomes steeper than the slope of repose of the ground and the warped wing will act partly as a sloping retaining wall, therefore its thickness must be increased with the change in slope and



Steel Flume Inlet With Warped Surfaces, Idaho.

at the vertical end will have the dimension of a vertical retaining wall. Often reinforced concrete warped surfaces with buttresses can be used to advantage. The warped wings should be made sufficiently long to form an angle with the direction of flow not greater than 30 degrees and preferably smaller. Straight vertical wings placed on an angle of 30 degrees to 45 degrees to the axis of the canal have to a certain extent the same effect as warped wings but are not so efficient. Right angle wings are cheap and easy to construct but unless riprap is used at the outlet to form the transition there is a small loss of head due to the sudden change in velocities. Riprap at the outlet is also necessary to prevent the erosion caused by the high velocity and eddies due to sudden change in velocity. If properly riprapped this form may be preferable to the second type. A short length of concrete lining about 3 inches thick is cheap and efficient.

Details of connections and protection of ends.

The proper design and construction is very important, for a large percentage of failures are due to poor connections. When flumes are built across ravines the ends should extend some distance beyond the edges of the ravines. The wings and connections may be made entirely of wood or of concrete. The latter is much preferable. Wood is only used for wooden flumes. Two forms are generally used. The first form consists of the vertical wings placed on an angle of 30 degrees to 45 degrees and of an inclined floor which extends downwards from the edge of the flume floor on a slope of 3 vertical for 10 horizontal. The second form consists of right angle wings extending from the ends of the sides of the flume into the banks and of a cut off apron extending vertically below the floor of the flume. This apron is built with and in the same plane as the wings. This form is cheaper than the first but requires considerable riprap or paving. A third form which has been used successfully is obtained by using at each end a short length of flume whose section is wider and deeper than the main flume, placed so that its floor is 3 or more feet lower than the floor of the main flume. The space above the lower floor is filled up to grade with well tamped earth.

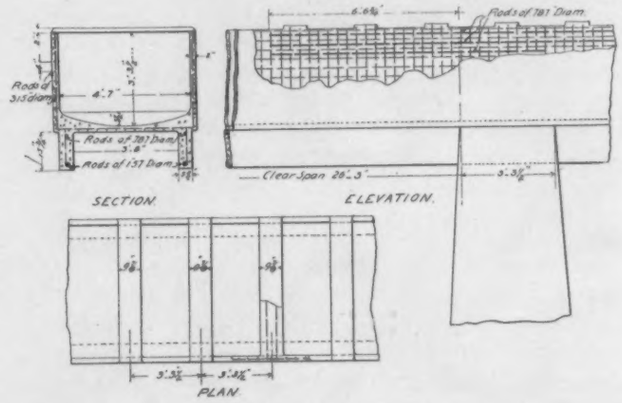
When concrete is used, either the form may be the same as for wood, or warped wings may be used. To connect the end of a wooden flume with the concrete, an abutment wall extends well below the ground surface and supports the end of the floor, the end floor sill being embedded in and bolted to the concrete. The wing wall extends well against the end of the sides of the flume and surrounds the end posts which are bolted to the concrete. To connect the end of a semi-circular steel flume with the concrete the edge of the end sheet should be turned over at least 6 in. and embedded in the concrete abutment on which it should bear for a length of at least 9 or 12 in. For all forms of inlet and outlet it is very important that cut off wings and aprons should extend into the bank and below the bed of the canal to a depth equal to about the depth of water, for ordinary soil. The outlet always requires riprap or bed protection for considerable distance downstream.

Flumes of Escondido Mutual Water Company.

This company has built several small reinforced concrete flumes on the side hill where it is necessary to cross ravines. The clear spans vary from 14 ft. 6 in. to 23 ft. The concrete is composed of 1 part of cement to 2 parts of sand and 4 parts of gravel. The reinforcement consists of corrugated bars. Where the span is wider the flume rests on concrete piers. One flume has a total length of 62½ ft. divided into three spans of 26, 19 and 17½ ft. by two intermediate supports, one a concrete pier and the other a large boulder. The flumes cost about $2.10 a foot, or $21 a cu. yd. Labor averaged $2.50 a day, cement $4 a barrel. Sand and gravel were hauled 1 to 3 miles. The lumber was obtained by tearing down old flumes.

Reinforced concrete flumes on Canal of Hamiz, Algeria.

These flumes carry the water of the main canal over two depressions. The two flumes are 92.5 ft. long and 187 ft. long, supported on piers, spaced 29 ft. 6½



REINFORCED CONCRETE FLUME OF HAMIZ ALGERIA.

in. center to center. The inside dimensions of the flume are 4 ft. 7 in. for the width and 3 ft. 3½ in. for the depth at the center, the flume having a concave floor. The sides of the flume are tied to each other at the top by means of tie beams 9⅞ in. wide, spread

3 ft. 3½ in. center to center. The sides and tie beams are 2 in. thick. The flume is supported on two reinforced concrete beams which form one body with the superstructure. The reinforcement consists of iron rods .315 in. in diameter, placed transversally and longitudinally in the sides and floor, the transversal rods extending into the tie beams. The rods form a net of 4 in. mesh. The beams are 15¾ in. high and 5½ in. wide and reinforced at the bottom with a rod 1.57 in. in diameter, and at the top with a rod .787 in. in diameter. These rods are tied to the reinforcement of the superstructure by means of vertical iron wire .275 in. in diameter. Above the piers to resist the stresses due to the negative bending moment, the reinforcement is strengthened by three round rods .787 in. in diameter, placed in the upper portion of the sides and extending on both sides of the pier for a distance equal to one-fourth of the span.

The mortar used in constructing this flume was composed of 1100 lbs. of cement to 3.2 parts of sand. The total cost was $4.95 a running foot. The flumes were tested when completed and submitted to a load of 1000 lbs. per lineal foot for 24 hours, which they resisted very well.

SUMMARY OF DEDUCTIONS OF IGNITION OF MINE GASES BY INCANDESCENT LAMPS.

Further useful information on causes of mine explosions has just appeared in Bulletin 52 of the U. S. Bureau of Mines on the ignition of mine gases by the filaments of incandescent lamps. The following is a summary of conclusions:

That glowing filaments may ignite gas seems to be proved by the fact that in 58 tests in which the gas was ignited the filaments continued to glow 2 to 59 seconds after ignitions had taken place.

The tests did not prove so conclusively that the spark that occurs when the filaments are broken is not the cause of gas ignition, although the following evidence seems to show that the unassisted spark can not ignite gas: Fifty tests made upon 50, 60 and 120 watt lamps, each of 110 volts, showed a greater percentage of ignitions when the lamps were connected in multiple than when they were connected in series, although the breaking spark was drawn at 110 volts with the lamps in multiple as against 550 volts with the lamps in series.

By breaking a non-inductive 550-volt circuit between a steel contact and a carbon contact, it was found that when the current exceeded 0.15 ampere an ignition was always obtained when the circuit was opened. Yet 10 tests made with five 110-volt lamps connected in series across 550 volts produced no ignition, although the filament of the tested lamp carried one-half an ampere, and the spark must have been drawn at 550 volts. Neither were ignitions obtained from 11 similar tests made with lamps carrying approximately 1 ampere.

The authors believe that the spark that is drawn when a lamp filament is broken is to a great extent "blown out" by the entering current of gas. To prove this assumption, a 50-watt, 55-volt naked filament was connected in series with non-inductive resistance and 0.5 ampere (one-half normal current) at 110 volts was passed through the circuit. The filament was then broken by gradual pressure, which distorted it until it snapped off. Five ignitions were obtained from six tests made in this way. Similar lamps were then connected in series with non-inductive resistance across 550 volts, and the filaments were disrupted by smashing the lamp bulbs. Five tests were made, three with a current of 0.6 ampere and two with a current of 0.7 ampere. No ignition was obtained in any of the five trials, although the current was 20 to 40 per cent greater and the voltage 400 per cent greater than in the five tests that gave ignitions with the naked filaments. It is therefore manifest that the inrushing gas has a quenching effect upon the spark.

Five tests were then made by connecting a 175-watt, 55-volt lamp (normal current 3.5 amperes) in series with a non-inductive resistance of such value that 2.25 amperes flowed through the filament when 550 volts was impressed across the lamp and resistance. The lamp was surrounded with gas and smashed while carrying this current. No ignition resulted from five trials, although the current broken was greater and the voltage ten times as great as in the case of lamps that invariably produced ignitions when broken while burning under normal conditions.

The authors are inclined to believe that the likelihood of gas ignition by standard carbon filament lamps is a function of the cross section of the filaments. The filaments of 24 different types of standard lamps were measured and the cross sections of the filaments were compared to their tendency to ignite gas, as expressed in percentage of ignitions in a given number of trials. All filaments having a cross section of 0.000177 square centimeter or less failed to ignite gas in the series 1 tests. All filaments having a cross section of 0.000234 square centimeter or more invariably ignited gas under the conditions of the series 1 tests; filaments having a cross section of 0.000194 square centimeter ignited gas in 50 per cent of the trials; and filaments having a cross section of 0.000215 square centimeter ignited gas in 83 per cent of the trials. It is true that a similar relation existed between the current flowing in the filaments and the percentage of ignitions that they gave, but the authors do not regard this relation as significant, because they believe that the spark that is drawn when a filament is broken is not responsible for the ignition of gas.

If the bulb of a glowing incandescent lamp is smashed while surrounded by an explosive mixture, and if the filament is not broken by the jar of the blow, the filament is first cooled by the inrushing mixture and then broken by it. Of course the cooling and the breaking are almost simultaneous, but the authors believe that ignition, if it occurs, takes place during the period of cooling and before the filament is broken.

If this hypothesis is correct, there are two reasons why large filaments ignite gas more readily than smaller ones: First, the temperature of the larger filaments will not be so greatly reduced before they are broken; and, second, the larger filaments will not so quickly succumb to the breaking action of the inrushing gas.

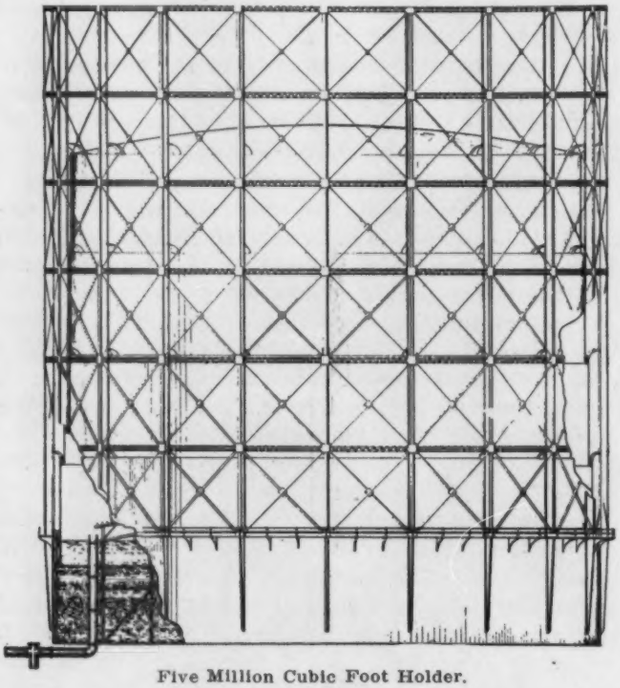
GAS ENGINEERING

DISTRIBUTION OF GAS.—III.

BY E. C. JONES.

The process of manufacturing gas may be said to end with the measurement of the gas by the station meter, and the distribution begins with the gas-holder where the gas is stored.

No objects along the sky lines of cities and towns are more familiar and prominent than the gas-holders, and probably there is nothing so little understood by people in general. There has always been an air of mystery surrounding these receptacles for gas, and they have been considered as dangerous neighbors. Firemen hesitate before fighting fires in their vicinity; while as a matter of fact there is nothing so simple as the principles and construction of a gas-holder, and there is nothing so safe and free from danger of destruction by fire or explosion.



Five Million Cubic Foot Holder.

It must always be remembered that gas-holders are for storing illuminating gas, which will not burn nor explode unless it is mixed or in contact with the right amount of oxygen or air. If it were possible to plunge a firebrand into a gas-holder filled with gas, the fire would immediately be extinguished. If a malicious person should punch holes in the side plating of a gas-holder, and light the gas, it would burn from the orifices the same as from a gas burner, until the holder in emptying extinguished the burning gas by submerging the holes in the water of the tank.

A gas-holder consists of a tank filled with water, and the actual holder or bell which is open at the bottom and is provided with a crown at the top. This bell rises and falls according to the quantity of gas contained in it. The water in the tank prevents the escape of gas, and presents a resisting surface to the gas entering the holder thus causing the holder to rise; it is also the means of expelling the gas as the holder is emptied.

Gas is admitted to and discharged from a holder through inlet and outlet pipes which pass under the tank and up through the bottom of the tank, and through the water in the tank to a point above the surface of the water. These pipes are each fitted with a drip box and valve in the horizontal section of pipe outside of and near the tank. The drip boxes are called dry-wells, and are for the purpose of receiving condensation of water from the gas.

The early holder tanks were built of brick in excavations in the ground. This was before the present age of steel with its wonderful achievements.

The first brick tank was built in 1818 and as the sizes of holders grew with the increasing magnitude of the gas business, concrete was in some cases substituted for brick.

The underground tank had many advantages, chief of which was its durability, for a well constructed tank would last indefinitely, but with the increase in sizes the engineering difficulties were multiplied. There was a lack of uniformity in earth strata, and expense and trouble in pumping and controlling underground water. With the advent of steel plates and shapes of high tensile strength, the all steel tank constructed above ground gradually superseded the underground tank of masonry. Steel tanks are now built upon a concrete pancake, supported by good earth foundation, or resting upon wooden or concrete piles according to the character of the ground, and the element of uncertainty which always confronted the engineers who built masonry tanks, is removed.

The first gas-holders consisted of a single section or "lift" of side plating, and a crown or roof. This holder rose and fell in a water tank a little larger in diameter than the holder, and containing more water than the gas capacity of the holder. It is obvious that these holders were limited to comparatively small sizes, and to economize ground space, and construction materials, the telescopic gas-holder was designed. In this form of holder the tank is made sufficiently large in diameter to contain two or more sections or lifts, one within the other like the extension parts of a telescope, but unlike the telescope the sections are made large enough so that these annular rings move freely without touching. Only the inner or smallest section is provided with a crown or roof, and on the bottom of each section is fastened a hydraulic cup filled with water from the tank. On the top of the second and each succeeding lift is a "grip" formed of channel iron and plates, exactly the reverse of the cup, so that when the inner lift is filled with gas, the cup on the bottom filled with water engages the grip on the top of the second section and lifts it out of the tank, the water in the cup forming a hydraulic seal or joint to prevent the escape of gas. The holder is raised by gas

forced into it by the pressure exerted by the exhauster, and the buoyancy of the gas contributes its share to lifting the holder.

In the days of single lift holders and low gas pressure, the weight of the holder if permitted to rest entirely upon the body of gas contained in it would cause excessive pressure on the street mains, and to avoid this a system of counterweights was used to reduce the weight of the holder. The crowns of early holders were sustained in shape by trusses, but this practice has been discontinued and crowns are now laid out during construction on a wooden framework, supporting rafters cut to the curvature of the crown, erected on and fastened to the bottom of the tank to keep it from floating. When the holder is in commission the gas inflates the crown and it retains its shape. This is known as a "balloon" crown.

Advances in the art of using gas have demanded increased pressure on the street mains, and this coupled with the introduction of sensitive pressure regulators at the outlet of gas-holders, has made it possible to abandon all counterweights and construct holders of many lifts of different weights, so that the pressure exerted by a five lift holder may be five inches on the inner lift and fourteen inches when all five lifts are inflated, without inconvenience to the gas supply.

The largest gas-holder in the world is located at the Astoria Works of the Consolidated Gas Company of New York. It has a capacity of 15,000,000 cu. ft. The next in size is in London, with a capacity of 12,000,000 ft. There is a 6,000,000 ft. holder in Los Angeles, and there has recently been built at the Potrero Station in San Francisco a five lift 5,000,000 ft. holder in a steel tank above ground.

Until recently the pressure with which gas was distributed depended upon the weight of the holder pressing down upon the gas. This varied constantly with the height of the holder, and while it was possible to reduce the pressure by station governors, it was sometimes difficult to maintain sufficient pressure during peak demands, because the pressure could not be increased. The use of a reciprocating pump or rotary exhauster on the outlet of the holder for increasing the pressure was attained with danger of interruption of the gas supply. Such a pump or exhauster when shut down would act as a valve to shut off the supply of gas.

The rotary fan, or the Sturtevant type, is now used as a "booster" for increasing pressure on the street mains. It is placed near the outlet to the holder, and by its use any desired pressure may be maintained regardless of the pressure exerted by the gas holder.

A fan of this kind is so constructed that there is sufficient space between the ends of the fan blades, and the shell of the fan to permit the unobstructed passage of gas in the event of a sudden shut down of the motive power for driving the fan.

Cities and towns are usually supplied with gas through a system of cast iron pipes known as "mains" under a low pressure system. This means pressure as measured by a column of water of from 2 to about 12 ins., or expressed in pounds per square inch from 1/13 to about ½ pound.

The trunk mains leaving the gas works are of the largest size in the district, and are gradually reduced in size as they extend outward into the district supplied with gas. It is essential that the distributing system shall be arranged in complete circuits to provide circulation of gas. A run of pipe not tied into the system so as to make a circuit is known as a "dead end" and these should be avoided as much as possible.

The pipes used for conveying gas were, at first, all of cast iron and were of small sizes, beginning with two inches in diameter. It was soon discovered that cast iron pipe of less than 4 in. internal diameter was not strong enough to withstand the strains due to freezing and thawing or disturbances of the ground, and wrought iron pipe was substituted for the smaller sizes. Cast iron mains are now used for conveying gas for low pressure distribution in sizes from 4 in. to 48 in. diameter, the size of cast iron pipe is always expressed in inches of internal diameter.

Gas mains are laid at an average depth of about 3 ft. cover of earth, above the top of the pipe, at this depth the pipe is secure against surface disturbances due to steam rollers and jars of heavy teaming.

In countries where the ground is frozen in the winter time has been considered necessary to lay gas mains at a greater depth, but experience has proven that mains laid at an ordinary depth are imbedded in frozen earth throughout the winter, while mains laid at greater depths are subject to the strains of frequent freezing and thawing during the cold season. It is a well known fact that frozen ground begins to thaw from the bottom towards the surface from the effects of internal earth temperature.

In laying mains great care is necessary to properly grade the pipe so that any condensation of water will be drained to a low point where it may be removed by pumping it out. On level roads a fall of 12 in. in 600 ft. is sufficient, and in hilly districts the condensation naturally flows to the valleys. The condensation is trapped in a drip box which is a cast iron fitting placed in the line of main, and it is of sufficient size below the main to provide a reservoir for containing condensed water which is pumped out at regular intervals.

A wrought iron pipe extends from the street level, through the cover of the drip-box to within a few inches of the bottom of the drip. An ordinary bucket pump is attached to the top end of this pipe for the purpose of pumping out the water. A record of the quantity of water removed from each drip-box should be kept for reference. Sometimes an unusual amount of water pumped from a drip is due to water leaking into the main from broken water pipes or soil saturated with water, and such a record will often lead to the finding of a broken gas main or defective joint. A well laid main system should have as few drips as possible, and a study of ground levels will often eliminate drips without laying the main too deep or too shallow.

Cast iron pipes are joined by means of a bell

and spigot joint. The spigot or straight end of one length of pipe enters the bell of another length, and the space between the spigot and bell is filled with lead or cement. Cement joints when properly made are as strong as the metal in the pipe, and because of their rigidity any settlement or disturbance causes a broken main. There is some advantage in this as it is much easier to find a large leak than a number of small ones. Cement joints are made by first driving a hard roll of tarred rope into the joint and then filling the joint with a moist mixture of Portland cement and sand, after which another roll of rope is driven in on top of the cement. The joint is then finished and neatly pointed with cement and sand.

Lead joints are made by driving a roll of hemp or tarred rope into the space between the spigot and bell. A roll of soft clay is then placed around the pipe against the face of the bell, and a hole is left on the top, through which molten lead is poured into the joint until it is filled. Atfer the lead has cooled, the clay roll is removed and the lead is caulked into the joint by means of a caulking chisel; this spreads and compresses the lead until the joint is gas tight.

A preparation of lead known as lead-wool is now used extensively for joint making. The lead is in a fibrous condition and is caulked into the joint without heating. There is some saving of time and fuel in making joints in this way, and lead-wool may be used in wet places where it would be difficult and dangerous to use hot lead. Owing to the difference in the coefficients of expansion of iron and lead, the lead joint is never at rest, and small leaks develop. These are not large enough to warrant uncovering the joints and caulking them, but in the aggregate it amounts to a considerable loss of gas.

Cement joints are extensively used in the east and nearly all the cast iron pipe joints in California are of lead. The writer was a strong advocate of cement joints until the earthquake of 1906 demonstrated that mains laid with lead joints are flexible, and the damage done was much less than it would have been had rigid cement joints been used.

All pipes leading from the mains to supply gas to consumers are known as service pipes. They are of wrought iron or steel, and should be connected to the top of the main. The usual method employed is to drill, ream and tap a hole of the required size by means of a simple drilling machine attachable to the main. The male end of a street elbow is then screwed into the main and a second street elbow is then screwed into the first. This forms an almost universal joint, capable of movement in any direction without straining or breaking the service connection or main.

Services should always be laid so as to drain back to the main and should have as much fall as possible. All large services should be provided with a valve at the curb line for the purpose of quickly shutting off the gas in case of fire or other emergency. Ordinary service pipes were formerly ½ in. to 1 in. in diameter. This was in the days when gas was used almost exclusively for illumination, and the demand extended evenly over a long period from sunset to the time of retiring.

Gas now occupies almost exclusively the field of domestic cooking and water heating. Its importance for heating is rapidly growing, while it still retains an important and ever increasing part of the lighting business. This last was made possible by the timely invention of the incandescent mantles by Dr. Auer von Welsbach. These new uses for gas have changed the hours of gas consumption from the long lighting load to three distinct peak periods, due to the preparation of the three meals each day. These peak demands and the large momentary use of gas by automatic water heaters have necessitated the use of larger mains and service pipes. The smallest service now installed to insure an ample and uninterrupted supply of gas is 1¼ in. in diameter.

Wrought iron or steel pipes laid in the ground must be protected from oxidation, and every kind of paint has been tried as a preventive. Probably the best coating for iron or steel surfaces is made in the gas works and is a by-product of the business.

Oil tar when boiled in a still is freed from water, benzole, and some of its lighter oils, and when cooled the remaining tar is thinned by mixing with it a portion of the benzole taken from it. This makes an excellent paint and may be applied to the pipe by dipping or by means of a brush. For a second coat, tar is boiled down to a medium pitch, and this pitch is applied while hot in a heavy coat from one-eighth to one-quarter inch thick. This hot pitch will not adhere to the metal surface, but when applied over a coat of the tar paint it melts and amalgamates with the paint forming a rust proof coating, which in itself is neutral, that is, it contains no ingredients which will corrode iron or steel. Where oil gas is made this coating is asphaltum, and if coal gas is made, coal tar and coal tar pitch may be used with equally good results. This coating is a poor conductor of electricity, and in a measure prevents the effects of electrolysis on the metal pipes.

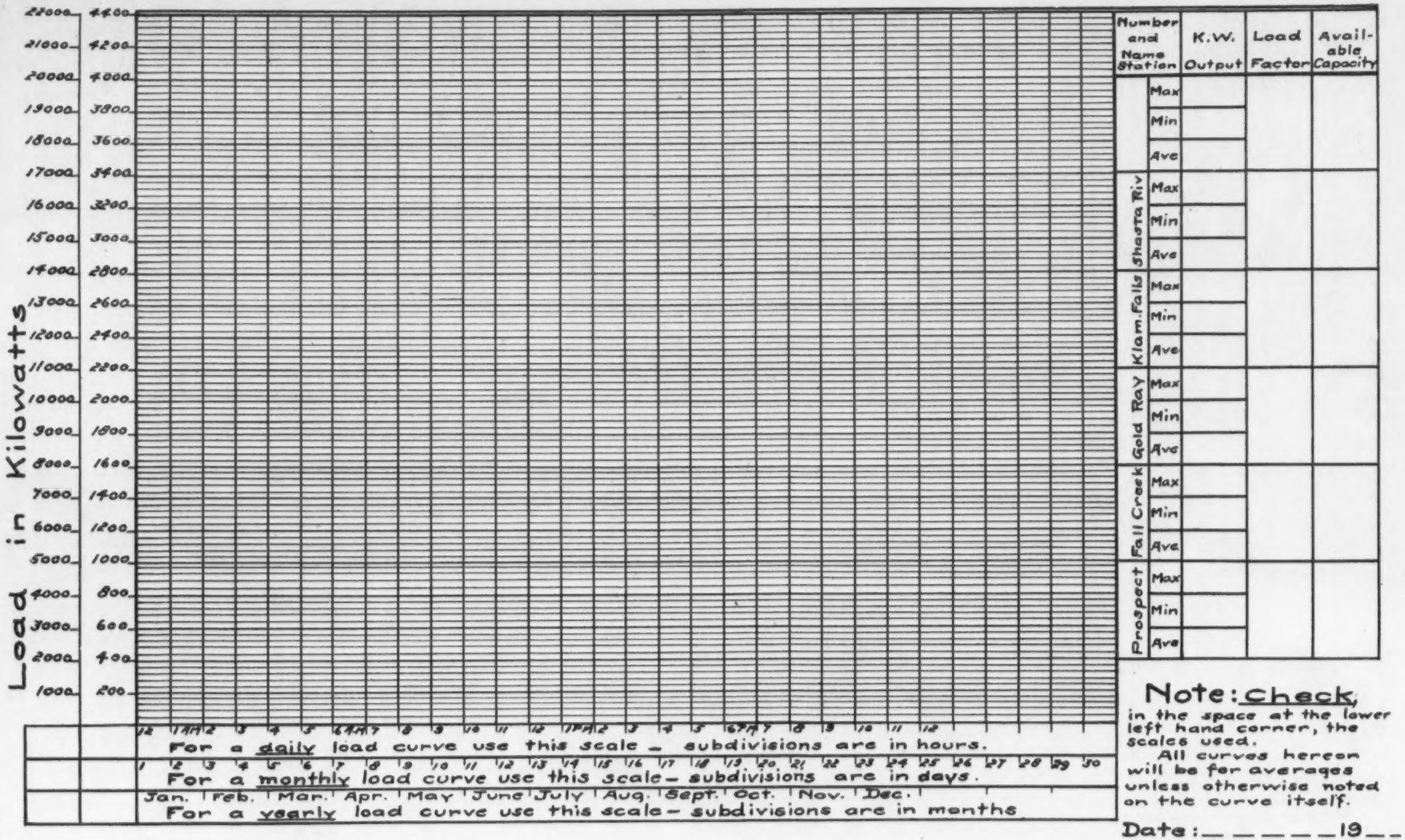
(To be continued.)

STANDARD LOAD CURVES.

Power plant operators do not like to write, and anything that simplifies record-keeping in the plant is welcomed by the operator. The California-Oregon Power Company is now using the accompanying chart as a standard in all their power plants to minimize the operator's work. Under the direction of Sidney Sprout, consulting engineer for the company, Mr. J. C. Boyle has worked out the details.

Inspection will show that this chart may be used to plot either a daily, monthly or yearly load curve, either maximum, minimum or average for any plant in the system. The lower edge of the diagram is laid off with three scales, one being subdivided into hours, the other into days, and the other into months, which are used respectively for daily, monthly or yearly curves. The left-hand vertical edge comprises a double scale, reading either from zero to 4400 kw. by 200 kw. intervals, or from zero to 22,000 kw. by 1000 kw. intervals.

This diagram has been standardized for use in each one of the plants, and is quickly filled in by an operator, who merely has to plot the corresponding points and make the required check mark.



Number and Name Station		K.W. Output	Load Factor	Available Capacity
	Max			
	Min			
	Ave			
Shasta Riv	Max			
	Min			
	Ave			
Klam. Falls	Max			
	Min			
	Ave			
Gold Ray	Max			
	Min			
	Ave			
Fall Creek	Max			
	Min			
	Ave			
Prospect	Max			
	Min			
	Ave			

Note: Check, in the space at the lower left hand corner, the scales used.

All curves hereon will be for averages unless otherwise noted on the curve itself.

Date: _____ 19__

Signed:

_____ Chief Dspr.

Standard Form for Plotting Load Curve.

LOCATING FAULTS IN UNDERGROUND CABLES

DETAILS OF THE MURRAY LOOP METHOD—II

BY C. A. GAINES.[1]

In the use of resistance tests to locate faults in large underground cables, special precautions must be taken to eliminate errors due to the connections necessary to perform the test, and it is the purpose of this article to explain some of the methods used to accomplish this result. Before proceeding further in detail I shall review several points I brought out in a paper upon this subject that I read recently before the Pacific Gas & Electric Company's Branch of the N. E. L. A.

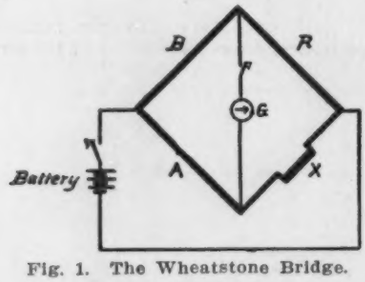


Fig. 1. The Wheatstone Bridge.

It is a well known fact that a cable tester, who regularly locates trouble on a telephone cable within a few feet of the actual fault, cannot come within a few hundred feet of the fault on a power cable, and the reason for this is plain when we consider the quantities with which he has to deal in each case. No. 22 copper telephone wire has a resistance of 85 ohms per mile, but a No. 2/0 conductor has only .41 ohms for the same length. One foot of No. 22 has a resistance of .016 ohms, while a foot of 2/0 has but .000078 ohms resistance.

Suppose the bridgeman uses two 6 ft. leads of No. 10 copper for connecting between his test set and the cable. These will have a combined resistance of .012 ohms, neglecting the contact resistance where they are all attached to the cable conductor. This resistance represents two-thirds of a foot of No. 22, a value which can well be neglected, and 154 ft. of the No. 2/0. In addition to this we have also to consider the connection at the other end of the cable where two conductors are tied together to form a loop.

It usually happens that the terminals of a power cable available for connections are either the knife blade of a disconnecting switch, or some threaded bolt, the nut of which must not be loosened for fear of putting out of alignment the blade or jaws of the switch. The tester, on the other hand, is confronted with the question of making a good electrical connection with negligible resistance, or else the question of eliminating the contact resistance at the same time that the correction is made for the resistance of the leads. The value of the contact resistance usually varies from .001 to .002 ohms, but may be many times that value. When the connections can all be clamped under nuts, or in other ways made secure, this contact resistance need not be considered. In fact if it never became greater than .002 ohms one could usually neglect it as this represents but 25 ft. of No. 2/0, but it is so liable to be greater when you least expect it that time will be saved in the long run by including it in the test for the resistance of the leads.

Another reason for the more satisfactory results obtained with telephone cables when locating trouble is due to the fact that the Wheatstone bridge is more accurate when measuring resistance from one ohm to 100 ohms than when dealing with values from 1.0 ohm to .01 ohms. The two most common tests—the Murray loop and the Varley loop—are both based upon the well known principle of the Wheatstone bridge, in which three known resistances with one unknown resistance, arranged as shown in Fig. 1, are adjusted until, with battery key closed, there is no deflection when the galvanometer key is closed. When such a balance has been obtained the four resistances are related to one another as shown in the equation $A/B = X/R$, and therefore

$$X = \frac{AR}{B}$$

A convenient Wheatstone bridge can be made by stretching a piece of resistance wire between two terminal blocks, fastened at each end of a scale, preferably divided into 100 units, and the battery connection arranged to slide along this wire. This slide wire takes the place of A and B in Fig 1, and the resistance R (Fig. 1) is supplied by some known resistance, which may or may not be adjustible.

In both the Murray and the Varley tests a loop is formed by joining the faulty conductor with a good conductor at the farther end of the cable. This connection should have as low a resistance as possible, particularly when using the Murray loop test. This

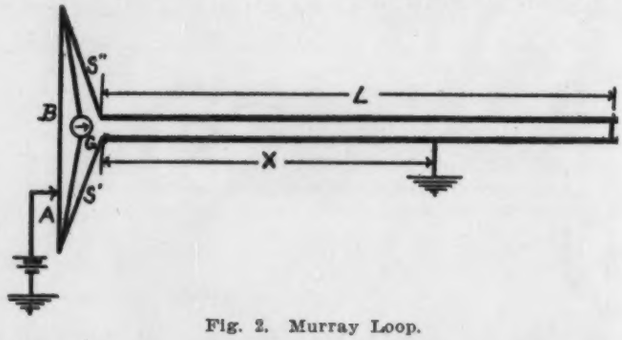


Fig. 2. Murray Loop.

latter method of testing is by far the most simple and readily understood, and particularly adapted for use with a slide wire bridge, for with this form of bridge, with a 100 unit scale, the reading obtained on the slide, gives the distance to the fault directly as a per cent of twice the length of the cable.

The connections for the Murray loop test, using a slide wire bridge, are shown in Fig. 2, in which "A" and "B" together represent the slide wire; S'

[1]Cable testing expert for the Pacific Gas & Electric Company, San Francisco.

and S″ are the leads to the cable; L is the length of the cable in feet and X the distance to the fault in feet.

In order to eliminate the error due to the leads S′ and S″, the bridge wire can be calibrated to include them and a correction curve made as in Fig. 3. The connections are then made as in Fig. 4.

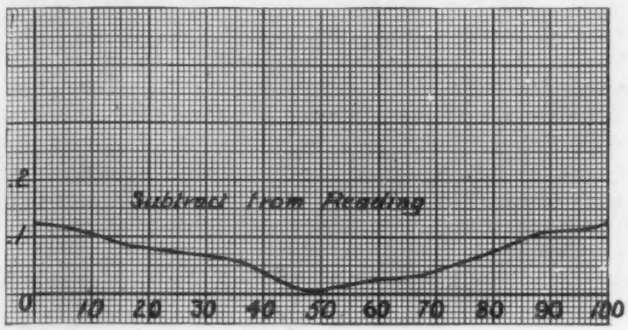


Fig. 3. Chart for Murray Loop.

In using the Murray loop test the battery connection is moved along the slide until the galvanometer is not deffected and we then have the length of cable as far as the fault balanced against the remainder of the cable loop in the same proportion as A is to B.

$A/B = \frac{X}{2L-X}$. If this is true, then the proportion

$A/A+B = \frac{X}{2L-X+X} = \frac{X}{2L}$ is also true, and we have X in feet.

X in feet $= \frac{2AL}{A+B}$ in feet. As mentioned before, if $A+B=100$, then $X = A\%$ of 2L.

It should be noted that with the slide divided into 100 inches, 100 centimeters, or 100 units of any size, that A is a per cent of twice the length of the cable m. It is a very common error to forget that

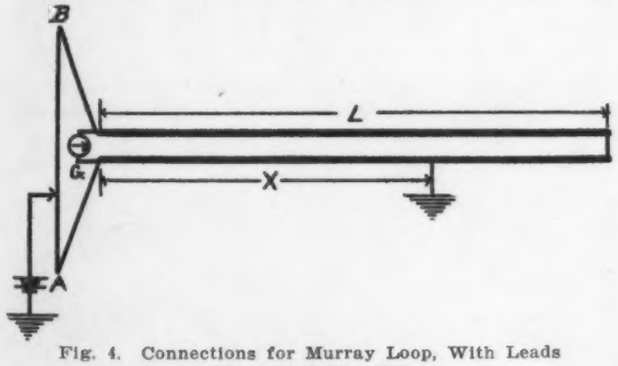


Fig. 4. Connections for Murray Loop, With Leads as Part of Bridge Wire.

"two." Where a bridge is made especially for fault location it can be divided into 200 divisions and the equation becomes X = A% of L, and that troublesome "two" is eliminated.

Suppose a fault develops in a cable midway between two stations, then with a 100 centimeter bridge A will be 25 cms., giving the distance to the fault as 25% of 2L, which reduces to 50% of L. With the 200 centimeter bridge A becomes 50 cms and the distance to the fault is directly 50% of L.

The slide wire bridge will be found to be more accurate if the resistance of the entire bridge wire is approximately equal to the resistance of the cable loop, and in designing a bridge for cable testing one should calculate the average resistance of the cables upon which it is expected to use it and select a resistance wire accordingly. For power cable work one should also endeavor to get a bridge with as large carrying capacity as possible, so that a current can be used giving an appreciable drop in the large conductors found in power work.

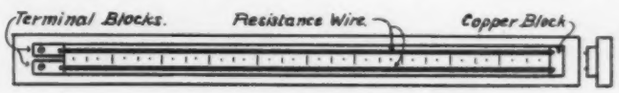


Fig. 5. Simple Method of Slide Wire Bridge.

A simple method of constructing a 200 unit bridge is shown in plan view in Fig. 5. The two resistance wires stretched along the 100 CM scale are joined by a heavy copper block at one end, and terminate in two heavy terminals at the other end of the scale.

In an emergency a length of bare copper wire can be attached to one conductor and run around the room, returning to the other conductor of the cable loop. Any d.c. source can be used to furnish current, one side being grounded and the other one through a bank of lamps, or some other convenient resistance, arranged to move along the bare wire until a balance is obtained, as shown by no deflection of the sensitive voltmeter which is connected to the two terminals of the cable loop. The ratio of the shorter length of the bare copper wire from the sliding connection to the cable, to the entire length of bare wire, is the same ratio between the distance to the fault and twice the cable length.

OIL PRODUCTION RAPIDLY INCREASING IN MEXICO.

Shipments of crude petroleum from this district steadily increase. During the last quarter of 1912 declared exports to the United States of crude oil amounted to 1,568,169 barrels and through the Tuxpam consular agency 1,337,182 barrels. In addition the Waters-Pierce refinery has been taking about 6000 barrels and the railway company about 12,000 barrels daily. Consumption from these sources amounted to about 1,656,000 barrels during the same period. In addition a considerable amount of crude oil was shipped to the Pearson refinery at Minitatlan, while a much greater amount was shipped there during the first quarter of 1913. A conservative estimate as to crude oil shipped from and consumed in this consular district during the December quarter would be about 5,000,000 barrels. This will probably be greatly exceeded during the first quarter of 1913. Because there are only 22 ft. of water at La Barra at Tampico, while at Tuxpam oil tankers can be loaded at sea. Tuxpam is rapidly displacing Tampico as the leading port for shipping crude oil.

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Labor Disputes and the Regulating Commission

A situation has developed in California during the past week that materially concerns every public utility company of the West. The status of affairs is about as follows:

An organization, hailing itself as the Light & Power Council of California and constituted largely by the gas makers, electricians and other labor elements of one of the largest distributers of gas, water and electricity in the West, has openly demanded, without admitting any possible recourse to arbitration, an increase in daily wage and a relief from labor one day in seven with full pay.

That this group of men is in nowise connected with any hitherto recognized labor organizations and thus summarily make such demands adds another entanglement to the problem. Casting aside this phase of the situation, however, the question of the wage scale and its increase or decrease constitutes in itself a grave and mighty problem not alone to the utility company and its employes but to the thousands upon thousands of consumer citizens it serves.

If these men are not receiving a proper wage an injustice is being done them and they should find relief. On the other hand, the citizens at large, who under commission regulation must provide the utility company with a fair return over and above operating costs, are grievously wronged if there is no justice in the contention. Hence the real parties to the issue are the employes of the utility company and the consuming public.

There is no possible method of equitable rate-fixing that prescribes the upper limit of revenue which a corporation may receive without being sure of the outgoing expenses. It is as futile as an attempt to measure an Hawaiian rainfall by means of an upturned barrel without at the same time measuring the water that escapes through the open bung-hole. That there is often justice in the demands of labor no one can deny. That the people, too, under commission regulation, are likewise deeply involved everyone must equally admit.

It would seem, then, that our effective commission regulation only half-way serves its usefulness. That this selfsame commission should in addition be empowered to review labor contentions with public utility companies with full and complete powers to act, seems both rational and reasonable in order to dispense justice to utility, employe and public alike.

A Forceful Publicity Campaign

Public enlightenment means much to the modern utility company. A forceful illustration is to be found in a recent publicity campaign at Pomona, California. In this municipality of about 15,000 inhabitants, situated near the famous San Antonio plant, the mother of modern long distance hydroelectric installations, the socialistic element endeavored to arbitrarily reduce the rates of the Southern California Edison Company, the utility organization serving the city of Pomona.

Upon this element appearing before the city fathers, the city council said that it did not believe its members were qualified to pass upon the questions

but suggested that the powers of regulation be transferred to the railroad commission of the state by popular vote. The socialists, however, preferred to submit ordinances to the citizens at the regular municipal election. These proposed to make the gas rate 90 cents instead of $1, the base rate for electricity 5½ cents per kw.-hr. instead of 8 cents, and a reduction of about 25 per cent in the water rates. The proposed rates were determined, apparently, without special investigation or knowledge as to whether they would produce a fair return upon the investment.

The campaign and contentions of the Edison company, on the other hand, were scientifically conducted. An expert was put directly in the field. Sworn statements were laid before the people showing the operating expenses of the Pomona district for 1912; also figures bearing upon the investment values as appraised by Bion J. Arnold. The rate of return earned upon the investment was shown, contrasted with the prevailing rates upon which money could be borrowed in Southern California. Indeed the entire proposition was discussed as frankly as one business man would present a business proposition to another, The result of the election fully vindicated the general policies and methods of the Edison company, for the measure was defeated by a two to one vote.

This decisive victory must have a far reaching effect throughout the utility life of the West. Other utility companies would do well to heed the methods made use of in this notable campaign.

Two other interesting facts may be seen in this battle that clearly portray the trend of the times—the desirability of a small municipality to have its utility affairs under the state wide commission, and the necessity of a utiltiy company to be just and reasonable in its charges.

The many good points to be gained by a municipality placing its rate-fixing powers with the state commission have been too frequently emphasized in these columns to bear repetition. On the other hand the incident should be allowed to pass without calling attention to the necessity of reasonable and just procedure on the part of the utility company at all times. In these latter days when bitter political contentions may arise at a moment's notice, the all powerful weapons of truth and justice are necessary to win the day.

The A. I. E. E. Dispute

In a recent issue attention was called to the recent court action brought by certain Institute members to annul all transfers that have been made under the special section which has been in effect since June, 1912, and which expired on May 1, 1913.

Since the legality of transfers has been now questioned it would seem that all bitterness and personalities should be avoided. The issue is plain. The only true value that any honor has is that it may prove genuine. It may be true that some unqualified members have slipped into the wrong classification. This in itself is not so much to be deplored, however. That the great majority of transfers are justified, cannot be disputed; hence if there is the least question of a doubt as to their genuine legality, is it not best for the courts to pass on this question and settle it for all time?

Public Quality of A Public Service Corporation

A radical change is taking place in the public conception of what should constitute a public service corporation. It may be five years or more before this idea becomes a living fact, but that is no reason why corporation officials should not recognize its existence and prepare for its advent. The responsibility rests largely with corporation directors and managers themselves whether this country is forced into public ownership and operation of public utilities or whether it can continue to be benefited by private initiative, private enterprise and private capital as applied to the public service.

Until recently, it has been taken for granted that furnishing light, heat or power was just as much a branch of private business as supplying milk, butter or eggs. This has been practically the theory underlying the laws and this has been the opinion of those who built the power plants.

But if this assumption is correct, why should the people object to rate discrimination between large and small consumers? Has not all commercial business been reared upon the firm foundation that goods can be sold more cheaply at wholesale than at retail? Does not every public utility manager know that it costs more to supply electricity to twenty small light consumers than to one large power consumer? If, then, the supply of electric light and power is a private business, why shouldn't the largest consumer be given the lowest rate?

Yet we know that a corporation upon which everyone is dependent for service can be made the means whereby the big fellow can drive the little man out of business. Consequently, a few far-seeing men are beginning to recognize that an electric light and power company should not be considered as conducting a private business; rather should it be looked upon as the private agent carrying on a part of the public business. The public wants equality of rates for public service as distinguished from the necessary rate discrimination in private business. In other words, the public quality of the management is to be made paramount to its business quality.

This difference is well illustrated by the postal service or by the tariff. No discount is given to large purchasers of postage stamps, nor does a large importer pay a lower duty than a small importer. Suppose, however, that the small man was discriminated against in price, would he not be soon driven out of business by such methods? But is not that precisely what the public service corporations are doing, and is that not why the public are no longer willing to concede that the supply of electricity is no longer a private business? Does it not also behoove the corporations themselves to recognize that they are only the private agents doing a part of the public business?

Public service commissions already regulate the finances and service of such private management and the day is not far distant when the governmental stamp of approval will give the same endorsement as to the stability of their securities as it now does to government bonds.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

Karl Waechorst, an electrical engineer of Dusseldorf, Germany, is at San Francisco.

C. A. Walker, president of the Ely Light & Power Company of Ely, Nev., is at San Francisco.

K. G. Dunn, vice-president of Hunt, Mirk & Co., has returned to San Francisco from San Diego.

H. G. Aylesworth, Pacific Coast representative of several Eastern electrical manufacturers, is at Los Angeles.

W. R. Hamilton has recently joined the sales organization of Pierson, Roeding & Company at San Francisco.

Fred Leggatt, Pacific Coast manager of the Western Electric Company, is expected to return from an eastern trip on May 17.

Carl Bush of the A. G. Electric & Manufacturing Company, Seattle, is in Portland looking after the interests of the company.

F. L. Whipple of the Northwestern Electric Company has been elected secretary of the Jovian Luncheon Club in that city.

Allan M. Culver, head of the Denver Gas & Electric Company, was at San Francisco during the past week with Mrs. Culver.

Dr. Thomas Addison, Pacific Coast manager of the General Electric Company, has returned from a trip through the northwest.

Sidney Sprout, consulting engineer at San Francisco, is investigating an irrigation project in Arizona where a big dam is to be built.

R. H. Walker, manager Columbia Electric Company at Seattle, was at Forts Casey and Ward recently where the company has contracts for wiring on the fort buildings.

C. S. Bowie of Bowie & Love, electrical jobbers and supply dealers of Tacoma has just returned from a business and pleasure trip of 8 weeks' duration throughout the east.

F. T. Caldwell, superintendent of the Home Telephone & Telegraph Company at Spokane, Wash., has been appointed superintendent of telephones at Edmonton, Alta., Can.

W. N. Landerkin, formerly with Fairbanks, Morse & Company at Vancouver, B. C., has taken the position of traveling salesman for the Pacific States Electric Company.

E. L. Barnes, district manager of the American District Steam Company at Seattle, has returned from a business trip through Idaho, Western Montana and Eastern Washington.

Harry Byrne of the electrical department, Allis-Chalmers Manufacturing Company, New York, is making a pleasure trip along the Pacific Coast, spending some time in Seattle recently.

C. P. Deming, formerly with the General Electric Company Seattle, is now connected with the Fort Wayne department of the General Electric Company ot 326 Colman building, Seattle.

G. B. Rosenblatt, commercial engineer of the Westinghouse Electric & Manufacturing Company, connected with the Salt Lake office of the company, has just returned from a trip to Alaska.

C. F. Gilcrest, instructor in the electrical engineering department of the University of California, has been made head of the meter department of the San Joaquin Light & Power Company at Fresno, Cal.

Frank S. Drake of the Harriman electric system at Portland has been selected as superintendent of the Yakima Valley Transportation Company at North Yakima, Wash., to succeed **W. C. Baker** who has accepted a position in the east.

R. M. Buehler, formerly local district manager for the Mountain States Telephone & Telegraph Company at Phoenix, Ariz., has been transferred to Prescott, where he will fill the position of district manager. **W. Cockrell** will succeed Mr. Buehler at Phoenix.

E. A. Norton, sales manager of the Pacific States Electric Company at Seattle, and **Ross Hartley** and **F. J. Airey,** sales managers of the firm's houses at Portland and Los Angeles, respectively, are in San Francisco, attending a meeting of the concern's sales managers in the latter city.

W. R. Hendrey, for five years manager of the Seattle office of the Fort Wayne Electric Works and Sprague Electric Works, of the General Electric Company, has severed his connection with the above company to engage in electrical engineering and construction business in the Northwestern States with headquarters at 325 Yesler Way, Seattle. **H. L. Eicher** has been appointed manager of the Seattle office of the Fort Wayne Works.

M. L. Baden, Riverside; **F. P. Bailey,** Healdsburg; **J. F. Ball,** Sebastopol; **H. G. Baugh,** Petaluma; **G. J. Bundy,** Bakersfield; **H. T. Carlton,** Napa; **N. Cleveland,** Oakland; **D. I. Cone,** Berkeley; **T. B. Copeland,** Oroville; **P. L. Davis Jr.,** San Francisco; **F. B. DeLano,** San Francisco; **F. L. Gautier,** Oakland; **M. S. Gerend,** Berkeley; **R. C. Griffin,** Oakland; **C. Grunsky,** Stockton; **G. H. Hagar,** Anaheim; **G. A. Howell,** Stockton; **E. L. Hughes,** Red Bluff; **E. T. Kavanagh,** Vallejo; **C. I. Kephart,** San Francisco; **B. F. Kline,** Sacramento; **R. G. McCurdy,** Eureka; **T. L. Moody,** Laton; **J. W. Morton,** Oakland; **A. J. Twogood,** Riverside; **H. L. Weber,** San Francisco and **M. Young,** Carpinteria, have been granted the degree of Bachelor of Science in the College of Mechanics of the University of California.

OBITUARY.

Charles W. Van Norden, clergyman, author, educator and pioneer in high tension electrical transmission in California, died at Auburn, Cal., May 12, 1913, aged 69 years. Rev. Van Norden was born in New York State, and was for three years president of Elmira College, New York. He came to California in 1893, and held several Congregational pastorates in the Sacramento Valley. He was one of the prime movers in the formation of the Central California Power Company, whose plant at Alta was constructed by his son, Rudolph W. Van Norden. Before this system was taken over by the present Pacific Gas & Electric Company he was president of the company, and in 1901 he was elected president of the Pacific Coast Electrical Transmission Association. He is survived by a widow, three sons and two daughters. His life has been one of service and inspiration to mankind, and the world is better for his having lived in it. More cannot be said of any man.

MEETING NOTICES.

Portland Section, A. I. E. E.

The annual meeting of the Portland Section of the American Institue of Electrical Engineers will be held at the Hotel Oregon, Tuesday, May 20, 1913. The principal features of the evening will be an informal banquet, commencing at 7 P. M. sharp, entertainment all evening, and election of officers—after the banquet.

Jovian Rejuvenation at Los Angeles.

Thursday, May 22d has been set as the date of a big Jovian Rejuvenation at Los Angeles, when it is hoped to

initiate a class of fifty or more. The ceremonies will be held at the Union League Club, corner Second and Hill streets, beginning with the banquet promptly at 6:30 p. m.; this to be immediately followed at the same place by the initiation ceremony. All visiting Jovians are extended a very cordial invitation to attend. R. B. Clapp is Statesman.

Oregon Society, Engineers.

The regular meeting of the Oregon Society of Engineers was held Thursday evening, May 8, in their club rooms, 247½ Stark street. The meeting was addressed by Mr. Joseph N. Teal, president of the Oregon Conservation Commission. Mr. Teal discussed both federal and state conservation and declared that there should be both co-ordination and co-operation in development of the natural resources of the West. "When the government is about to build an inland waterway," he argued, "it should go a step farther and, if practicable, use some of this same energy in providing irrigation for nearby arid lands." He also emphasized the necessity of preserving the forests.

Oregon Technical Club.

The regular weekly luncheon was attended by a goodly number and those present were treated to a fine talk by Prof. F. L. Griffin of Reed College. His subject was "Modern Ways of Teaching Mathematics." Prof. Griffin believes in teaching in the various grades mathematics which can be applied to every day subjects about the student. That is, every part of the mathematical course should be complete in itself and the student should be able to apply same to practical, every day subjects and problems about him. The chairman of the day was J. R. Thompson. The luncheon took place on Monday instead of Tuesday, as announced previously.

Seattle Jovian League.

The Seattle Jovian League was addressed at its luncheon given May 9th by E. K. Nnoff, sales agent of the U. S. Steel Products Company, the company being host at the luncheon. Mr. Knoff's address dealt with some of the points involved in the manufacture of certain electrical wires and the drawing of steel and copper wires. The process of drawing to bring the wire to the proper diameter was fully explained. The various phases of insulation were also discussed at some length in the carefully prepared address. Thomas H. Bibber, sales manager of Edwards & Company, Inc., New York, statesman at large, was present and addressed the league, giving a brief history of the organization. Until further arrangements are made meetings will be held every two weeks instead of every week as heretofore.

Electrical Development and Junior League of San Francisco.

The monthly business meeting was held last Tuesday. Reports of standing committees were heard and adopted. The Code Committee reported the probable adoption of the proposed license ordinance by the Board of Supervisors. Mr. W. S. Berry, chairman of the committee having in charge the settlement of the differences between the central stations and contractors, with respect to service installations, reported a satisfactory solution of the question.

Suggestion was made that steps be taken looking toward the provision of a "house electrical," or Jovian headquarters at the 1915 Exposition, where all local as well as visiting Jovians and friends might be made to feel at home while visiting the fair. It is anticipated the suggestion will soon resolve itself into active shape and committee appointed to take up the task.

Portland Jovian Luncheon League.

The regular Thursday luncheon was held at the Portland Commercial Club. Mr. R. E. Halliday of the Federal Sign Company spoke on "The Development of the Federal Sign," and said in part:

The first Edison electric generator was installed in Abington, Wis., in 1886. The first electric sign installed in the United States was installed in 1890. Last year there was manufactured in the United States 80,000,000 incandescent lamps, while 8,000,000 are installed in electric signs. At present there is invested in electric signs in the United States $30,000,000. There is going to be a campaign on in Portland to install electric signs for large spectacular effects and endeavor to rival New York with these signs in some particular cases.

A motion was made and carried that the luncheons be discontinued during the summer, the same chairman and executive committee to hold over the summer, meetings to be called again in September.

BASEBALL AT PORTLAND.

The Pacific States Electric Company's crack baseball team went down to defeat before a team picked from the other electrical jobbing houses of Portland, last Saturday afternoon, the 3d, at Sellwood Park. The score stood 24 to 16 in favor of the "scrub" team. The winning team is to be dined by the losing team.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

Jacob Swallow, Mae Laws and Clarence W. Martin have filed a complaint against the Economic Gas Company of Los Angeles. They ask that the commission deny the application of the Economic Gas Company pending before it to issue bonds, and that it further find the office of the Economic Gas Company in contempt and penalize them for having issued securities, according to the complaints, without the consent of the commission.

The Palo Alto Gas Company has filed a complaint against the Pacific Gas & Electric Company, which was serving gas to the Palo Alto Gas Company at wholesale at 75 cents, and the Palo Alto Gas Company was retailing it to its consumers at $1.50. Thereafter the railroad commission reduced the rate in the city of Palo Alto to $1.20. Since then the Palo Alto Gas Company has offered the Pacific Gas & Electric Company 54 cents per 1000 feet, but the Pacific Gas & Electric Company has demanded 60 cents. The Palo Alto Gas Company now asks the commission to compel the Pacific Gas & Electric Company to accept 54 cents per 1000 feet.

The Great Western Power Company has applied for authority to use $225,000 of bonds, previously authorized, to reimburse its treasury for expenditures from income during the months of December, 1912, and January and February, 1913.

Authority has been granted to the Union Home Telephone & Telegraph corporation of Southern California to issue bonds to the amount of $161,000 to replace bonds which were borrowed.

The commission has granted the application of the Arizona-California-Nevada Telephone Company to sell its plant in Needles, Cal., to the Needles Gas & Electric Company.

The commission has granted the application of the Citizens' Light & Water Company to sell its property to the Claremont Domestic Water Company for $70,000.

Authority has been granted to the Mount Konocti Light & Power Company to issue $20,000 in stock and a promissory note for $5000. The proceeds from the sale of the stock are to be used in extending the company's lines. The company now operates in and around Lakeport and proposes to operate in Kelseyville, Upper Lake, and to extend its system into the mineral springs resorts of Lake county.

Application has been made by the Pacific Gas & Electric Company for authority to issue $5,000,000 of 6 per cent 10 year debentures. The company proposes that $3,750,000 shall be used for the reimbursement of the treasury for expenditures made from income. The balance of 1,250,000 is to be used by the company in general improvements over its system.

It is provided that the debentures shall be convertible into the common stock of the company on or before June 1, 1917, at $80 per share, between June 1, 1917, and June 1, 1919, at $85 per share, between June 1, 1919, and June 1, 1921, at $90 per share, and after June 1, 1921, at $95 per share. The company asked authority, for the present, to pledge the debentures as collateral security for notes to the amount of $4,000,000.

TRADE NOTES.

The city of Seattle has bought 12 Allis-Chalmers Co. air brake equipments, provided with emergency valves for the city's proposed municipal railway.

The Mumby Lumber & Shingle Company at Bordeaux, Washington, has ordered a 500 kw. turbine with exciters, switchboards, etc., from the General Electric Company.

The U. S. Reclamation Service has purchased of the Allis-Chalmers Manufacturing Company, nine motors and nine transformers for the Lake Keechelus project in central Washington.

Charles C. Moore & Company, engineers, Seattle, have the contract for an extension to the municipal lighting and power plant at Kamloops, B. C., same to be 600 kw., 80 per cent power factor.

The Northwestern Improvement Company has ordered from the General Electric Company a 1000 kw. turbine, generator sets, switchboards, etc., to be used in its mines at Roslyn, Washington.

Paine, Bailey & Co., 440 Market street, San Francisco, and F. F. Foster & Co., 443 East Third street, Los Angeles, are now carrying a complete stock for the Paragon-Sellers Company of Chicago.

The Westinghouse Electric & Manufacturing Company, Tacoma, is furnishing 20 alternating current motors to be used in the new F. S. Harmon & Company furniture factory at Tacoma. These motors vary in size from 1 to 25 h.p.

The Farnsworth Electrical Works announce their removal on May 10th to their new building, 549-551 Mission street, between First and Second, San Francisco, where they have the largest and most modern repair shop in the West.

The Ohio Brass Company of Mansfield, Ohio, was recently awarded a contract by the Boston Elevated Railroad company for 610 automatic air connecting coupler and draft gear equipments for heavy subway and elevated train service.

The Allis-Chalmers Company have obtained the motor contract for the Glable Milling & Grain Company of Portland, Oregon. These motors vary in size from 5 h.p. to 75 h.p. The total h.p. being 400 h.p. All the motors are 440 volt, 60 cycles, three-phase.

The largest induction motor west of the Mississippi River has just been installed at the Crown Columbia Paper Mill at Camus, Washington. It is the General Electric Company's Form P. induction motor, and is rated at 1800 h.p., 2200 volts, 60 cycles, three-phase.

The General Electric Company has received an order for one ATB-2-250 kw. (625 k.a.v., .8 P. F.) 3600 r.m.m., 240 volts, horizontal Curtis steam turbine generator set, with direct connected exciter, from the Humboldt Cooperage Company of Arcata, California. This order also includes switchboard and 30 induction motors ranging from 5 to 50 h.p.

Pierson-Roeding Company has been awarded a contract for approximately one-half million feet of Orangeburg fiber conduit for underground installation of the British Columbia Electric Railway Company at Vancouver, B. C. The company has also been awarded the contract for Locke suspension insulators and aluminum wire for the new transmission line of the British Columbia Railway Company at Vancouver, B. C.

The Puget Sound Traction, Light & Power Company has just purchased from the Westinghouse Electric & Manufacturing Company one 250 k.v.a. o.i. s.c., single-phase, 60-cycle transformer for 50,000 volts, three-phase to 2300 volts, two-phase transformation, to be installed at Issaquah, Washington, also one 1000 k.v.a. o.i. w.c., 50,000 volts, three-phase to 13,800 and 2300 volts, two-phase transformer, to be installed at Everett, Wash. A 13,800 volt electrolytic lightning arrester and 2 100-ampere, 13,800 volt oil circuit breakers, swicthboards were also purchased of the same company. The company purchased in Boston, through the Stone & Webster offices 2-1000 k.v.a, o.i. w.c transformers for the Tacoma smelter substation.

The Alaska Gasineau Mining Company, through the Guggenheim Syndicate of New York, have placed an order for two 2500 h.p. water-wheel equipments for the further development of their Alaska property, and in addition to the Henry unit which they installed last year. These will be equipped with Lombard governors and latest type of automatic water economy nozzles. These units are to operate under an effective head of 653 feet. The design and construction of this apparatus was specially investigated by Mr. H. L. Wollenberg and Mr. B. Thane, manager of the property, during their recent visit to San Francisco. The entire equipment will be built by the Joshua Hendy Iron Works at their Sunnyvale shops on designs and patents of George J. Henry Jr.

The Pelton Water Wheel Company have received a contract from the Pacific Gas and Electric Company covering one 20,000 h.p. single-discharge Pelton-Francis turbine for the new installation at No. 5 development. This represents the largest wheel of this design yet built, and will be equipped with needle-type by-pass and relief valves, mechanically connected to the governor. The operating head will be 497 feet and the speed 360 r.p.m. Elaborate precautions have been taken in the design of the thrust-bearing to insure successful operation, and special balancing features will be contained in the runner chamber so that the mechanical thrust-bearing will be employed only during the period of starting up or when there is no vacuum. This machine will be built in the company's San Francisco shops.

NEWS OF ELECTRICAL CONTRACTORS.

The Potter Electric Company of Portland, Oregon, have obtained the contract for the electrical installation in the new Troy Laundry Building in Portland.

The A. Z. Smith Electric Company, 934 Commerce street, Tacoma, is installing hoisting motors and cranes for the Pacific Lumber Company, near the city.

Wm. H. Smith Electric Engineering Company of Portland, was awarded the contract for the ornamental cluster lighting in the Teviliger Boulevard Park.

The Electric Construction Company, 937 Commerce street, Tacoma, has secured the contract for wiring the Betts building, between Fifteenth and Sixteenth streets on Pacific avenue. The contract amounts to about $1500.

The Ne Page, McKenny & Company, electrical contractors and engineers of Seattle, have been awarded the contracts for installing the ornamental cluster light parts in the Peninsula Park and Washington Park, Portland, Oregon.

The Columbia Electric Company, Seattle, is wiring the Fouts apartment building, one of the finest buildings of its kind in the city. It will be equipped throughout with electric cooking apparatus. It will be conduit installation calling for lighting, heating, power telephones, etc. The company is also working on a elaborate lighting scheme for lodge rooms and assembly hall in the Knights of Columbus building at Union and Harvard streets. This will be a three color arrangement operated by a theater dimmer. Another piece of work under way is the installation of a conduit lighting system and fixtures in a store and hotel building for W. D. Morse at Port Angeles, Washington.

NEWS NOTES

INCORPORATIONS.

WENATCHEE, WASH.—Central Washington Gas Company, $100,000, by Arthur Gunn, J. H. Stout and others.

BOISE, IDAHO.—Owyhee Irigation Power Company has been incorporated for $10,000,000 for irrigation and power in southern Idaho.

SANTA FE, N. M.—John J. Jackson, representing the Portales interests, has filed incorporation papers of the Portales Power & Irrigation Company and the Portales Utilities Company. The Portales Power & Irrigation Company is a formal organization of the Westinghouse Electric Company, which is behind a big pumping irrigation project at Portales. The company is capitalized at $300,000; stockholders being H. E. Rogers, S. E. Ward, and M. V. Peasles.

SAN FRANCISCO, CAL.—Exposition Terminal Railway Company, $100,000, shares $100 each; subscribed $10,000, by J. W. Hellman, J. McNab, W. H. Crocker, H. F. Fortman, Leon Sloss and J. W. McCarthy. The object of the corporation is to operate a railway on the exposition grounds at Harbor View for the transportation of exhibits and materials from the freight ships of the exposition to the various exhibit palaces and buildings. The road is to be about ten miles long.

ILLUMINATION.

HEMET, CAL.—The Southern Sierras Power Company will submit a proposition to the board of trustees of Hemet, to install an adequate lighting system for streets.

BREMERTON, WASH.—The Bremerton-Charleston Light & Power Company has applied to the Commissioners of Kitsap county for authority to establish a line of electric poles and wire along the county roads.

SAN FRANCISCO, Cal.—An elaborate and permanent system of street illumination will be installed on Kearny street from Geary to California within the next few months, and on October 22, will be dedicated as part of the opening exercises of the Portola festival, which begins on that date.

TRANSMISSION.

NAMPA, IDAHO.—The Beaver River Power Company will apply for a franchise.

GLEADA, ORE.—Florence, Oregon, Electric Company will lay a cable across the river to furnish light to this place.

POCATELLO, IDAHO.—The Bannock County Commissioners have granted a franchise to the Utah Light & Power Company to string transmission wire along, over and under the roads of the county.

KAMLOOPS, B. C.—J. J. Carment, city clerk, will receive bids until June 12 for a hydroelectric power plant, including water wheels, generators, exciters, transformers and switching eyuipment. Plans from DuCane, Dutcher & Co., consulting engineers, 915 Rogers building, Vancouver, B. C., on deposit of $15.

VACAVILLE, CAL.—A large force of men is engaged in constructing the new power line for the Pacific Gas & Electric Company west of here. This new line will be in addition to the company's present main line, which follows the railroad track and will carry 100,000 volts instead of 60,000, the voltage of the present system.

HONOLULU, HAWAII.—The estate of C. M. Cooke, Ltd., and the J. B. Atherton Estate, Ltd., have purchased a controlling interest in the Hawaiian Electric Company. The deal involved more than $500,000, and signifies a shake-up in the affairs of the big corporation in the near future. J. A. and L. L. McCandles sold their holdings, 2388 shares, which, with the previous holdings of the two estates, gives them 4400 of the 7500 shares of stock.

OROVILLE, CAL.—A fire destroyed a substation of the Pacific Gas & Electric Company on May 12, three 60,000 volt transformers being burned out. The immediate loss will be approximately $25,000, but the indirect loss may be much larger, for absence of power has shut down all work on all gold dredgers in the Oroville field, leaving an investment of millions idle. Short-circuiting of the high tension lines at Wheatland is stated to be the cause.

STOCKTON, CAL.—The steam plant of the Oro Electric Corporation, just put in operation, is supplying light and power to several hundred farms in San Joaquin county. The current is supplied over 300 miles of distributing system built within the past few weeks, and the steam plant will supplement the service until the Oro's plant at Belden, on the Feather River, is completed. The electrical current furnished over the Oro lines is used principally for the operation of pumping plants.

BOISE, IDAHO.—The Crane Falls water power plant on Snake River, which is to furnish electric power to lift water into the Gem Irrigation District, has changed ownership, passing from Smith, Carey & Chase to the Idaho Railway & Power Company; capitalized for $20,000,000. Smith, Carey & Chase started the installation of the Crane Falls power plant some time ago. The Idaho Railway, Light & Power Company will complete the plant, making it one of the best in its system; it will have a capacity of 15,000 horsepower. Temporary arrangements are made for the delivery of power to the Gem Irrigation District through lines from Swan Falls power plant.

HOOD RIVER, ORE.—The Pacific Power & Light Co. has stopped construction work on the pipe line and power house under way here. The heavier portion of the work of the mile-long pipe line had already been completed and crews of men were constructing the foundation for the power house, where 3000 horsepower was to have been developed. It is explained by the local office that the work is discontinued because of the inability of the company to dispose of its bonds at satisfactory figures in Eastern markets. When the money market becomes better it is declared that the work will be resumed. Albert S. Hall, former local manager of the Pacific Power & Light Company, who now has charge of the Hood River Gas & Electric Company, a subsidiary concern, says that all construction work of the company in the Northwest will cease.

SAN BERNARDINO, CAL.—The fight of the Southern California Edison Company against the invasion of the Southern Sierras Power Company, continues, and the new move of the Edison company is to protest against the construction of a pole line through the city of Redlands to serve the pumping stations. The State Railroad Commission has ordered construction suspended until the commission hears the application of the Empire Water Company to issue $200,000 in bonds to develop power near the San Jacinto Mountains. At the instigation of the Edison company an injunction suit now is in the local courts, in which an effort is being made to cancel the contract the city of Redlands made with the Southern Sierras Company. The new company won the first round, the courts declining a temporary injunction pending the final decision. Recently the Sierras company won out in the Edison complaint to the State commission seeking to prevent the invasion of the

pumping field in Lytle Creek, for the commission held the the new company held a blanket franchise dating prior to the commission's jurisdiction.

MEDFORD, ORE.—With the signing of a contract between the Portland Beaver Cement Company, the recently organized $600,000 corporation and the Rogue River Public Service Corporation, successor to the Rogue River Canal Company for the latter company to supply 2000 horsepower electric power a month during the next three years for the operation of the cement plant, the fact became public that a consolidation of power sites between Grants Pass and Rogue River is nearing completion which will involve property values exceeding $5,000,000. George Sanders has the work of consolidation in charge. Irrigation rights for 56,000 acres near Grants Pass have been secured from the state, ditches are now being constructed and if present plans materialize one of the largest irrigation and electrical power corporations in the state will be the result. It is now planned to construct power dams at Gold Hill, Savage Rapids and possibly Rock Point, take over the Ament and Golden Drift dams as well as the Rogue River Chicago Irrigation Company, and put them under one operating head. Indiana capitalists are behind the deal, headed by F. M. Fauvre, W. H. English, Indianapolis millionaires. The contract for the construction of a $500,000 cement plant has been let to the Leigh Hunt Engineering Company of Kansas City with an initial capacity of 1000 barrels. J. C. Burch, the president, is now in Portland perfecting arrangements regarding details of shipping, labor supply and other matters which must be settled before actual operations can begin.

TRANSPORTATION.

SAN FRANCISCO, CAL.—The board of trustees has passed an ordinance granting a franchise to the South San Francisco Railroad & Power Company to construct and run an electric railroad along Walker, Swift and Grand avenue.

LOS ANGELES, CAL.—The extension of the yellow car lines of Los Angeles Railway Company into Hollywood and Colegrove districts, with a view of affording improved car service, is being advocated by President Reynolds of the Board of Public Utilities.

PORTLAND, ORE.—Bolton, this side of Oregon City, on the Portland, Eugene & Eastern, will be the site of a mammoth car shop, machine shop and repair plant for the entire network of electric roads in the Portland, Eugene & Eastern system. The plant will cost upwards of $1,000,000; will cover 24 acres and be the largest carshop plant in the Northwest.

SACRAMENTO, CAL.—The Oakland, Antioch & Eastern Railway, which will soon be operating between San Francisco and Sacramento, has let equipment contracts sufficient for the first year of operation. Eight cars have been ordered from a Berkeley corporation; eight more were shipped from the East on May 1st, and another eight car order, deliverable August 1st, has been placed. Two 1800 h.p. electric motors will be here shortly, together with one express motor car, built especially for service in carrying farm produce and milk.

BOISE, IDAHO.—The Oregon Short Line has called for bids from the large electric power companies operating in the Southern Idaho field, for the furnishing of electrical power to that portion of the system it is proposed to electrify. The Great Shoshone Light & Power Company, and the Southern Idaho Light & Power Company, have submitted bids, and other companies, including the Telluride, which has power plants in the southeastern part of the state, will, it is understood, offer bids.

SAN FRANCISCO, CAL.—The Union Iron Works has delivered to the city all except one of the cars for the Geary street railway which this concern agreed to build. The other one is the car which got away at night when being conveyed to the car house and was damaged. It has been in process of reconstruction at the United Railroads car house, the restoration of it being attended to by the Union Iron Works and the United Railroads agreeing to pay the expense. The board of works and the finance committee of the supervisors have approved the payment to the Union Iron Works of $169,400, this being the contract price for twenty-two cars at $7700 each.

VISALIA, CAL.—The matter of the franchise for the Pacific Electric Company of Los Angeles through Tulare county came before the supervisors. The power company was defendant in a number of suits by southern Tulare county ranchers for erecting steel towers ten feet square at the base over the county in their desire to transmit power from the Fresno county plants to Southern California. For that reason a new route was selected. The supervisors insisted that the lines should not be strung diagonally across public highways but in spans of from 400 to 800 feet. To make an angle in the line was not desired by the company, who claimed that this would not be as safe. The matter was finally adjusted satisfactorily.

PORTLAND, ORE.—Robert E. Strahorn has resigned from the vice-presidency of the Oregon-Washington Railroad & Navigation Company and will hereafter devote his entire time to the construction of the Portland, Eugene & Eastern Interurban Electric system through the Willamette Valley. J. P. O'Brien, vice-president of the O.-W. R. & N. and general manager of the system, will take over the unfinished work in connection with the completion of the North Coast road in Washington. The resignation of Mr. Strahorn was placed in the hands of President J. D. Farrell in compliance with the recent decree of the Supreme Court of the United States which required a complete unmerging of the Harriman lines and by which no officer of any auxiliary company could be officially connected with any line in which the Union Pacific Company is interested.

TELEPHONE AND TELEGRAPH.

SOUTH PASADENA, CAL.—The Home Telephone & Telegraph Company has been granted a franchise in this city. G. B. Ocheltree, representing the telephone company, stated that as soon as the company could obtain necessary certificates of public necessity and convenience from the railroad commission, work would commence installing the necessary poles, wires, etc.

SAN FRANCISCO, CAL.—The telephone exchange planned for the Exposition will have equipment for 2000 stations and 30 operators. It will connect with all parts of the Exposition, and will be provided for long-distance service. Public booths will be scattered all over the grounds.

ANAHEIM, CAL.—The Pacific Telephone & Telegraph Company has obtained permission from the state railway commission to establish an exchange at Placentia. Construction work will begin soon as the necessary material can be placed on the site.

WATERWORKS.

OXNARD, CAL.—Sealed bids will be received up to May 27th for the construction of a municipal water plant.

BURLINGAME, CAL.—A resolution was adopted authorizing the sale of water bonds to the amount of $20,000.

BOISE, IDAHO.—One hundred thousand dollars will be spent this season by the Boise Artesian Hot & Cold Water Company in extending its system through the northwest portion of the city.

WATTS, CAL.—The board of trustees of Watts has determined that public interest and necessity demands the acquisition and construction of waterworks for supplying the city inhabitants with water. The estimated cost of said system being $85,000.